

## Introduction

Soil organisms play a critical role in terrestrial ecosystems. Soil fauna and flora affect nutrient cycling, aggregate stability, and trends in organic matter levels. In many ways, the activities of soil organisms are related to soil quality, which is one of the most important factors affecting agricultural sustainability.

Measurement of soil biological characteristics is essential to understand the role of organisms in soil and their influence on soil quality.

The National Soil Survey Laboratory (USDA-NRCS) established a Soil Biology and Carbon Research Program within the Global Climate Change Initiative. One of the primary objectives of this program is to evaluate and implement methods to measure soil biological characteristics related to labile soil carbon pools. Data generated from this program will aid NRCS scientists and others in understanding the effects of land management on carbon cycling in soil.

This poster will review the soil biological characteristics measured in this program and present data from preliminary evaluations.



Photo of a re-seeded native site on the Paypoint soils series in Nevada.

(classification: ashy over sandy or sandy-skeletal, glassy over mixed, mesic Durinodic Xeric Haplargid)

Photo of a native site on the Paypoint soils series in Nevada.



## Microbial Biomass

### What is it?

Microbial biomass is the living component of soil organic matter. Less than 5 percent of soil organic matter is microbial biomass.

### Why is it important?

Microorganisms control the flow of carbon and the cycling of nutrients in soil. Consequently, microbial biomass serves as an indicator of a soil's capacity to immobilize carbon and mineralize nutrients.

### How is it measured?

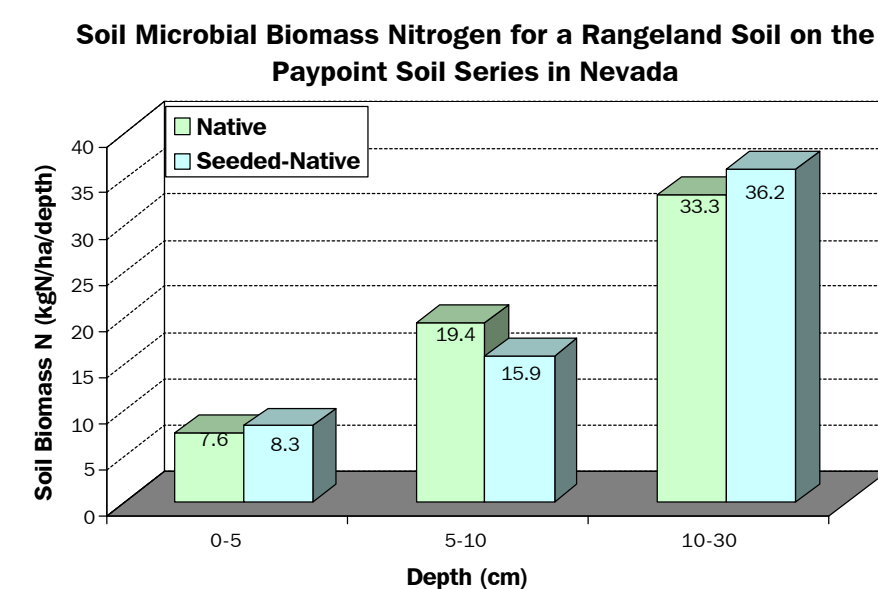
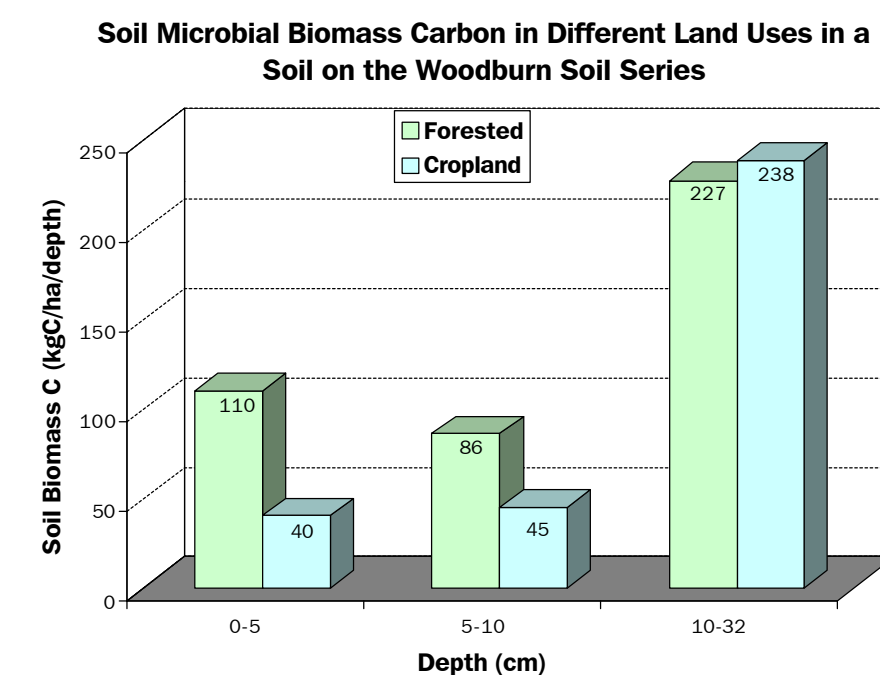
Soil microbial biomass is assessed by measuring the amount carbon and nitrogen released from the decomposition of dead microorganisms. Specifically, soil microorganisms are killed by microwave irradiation or chloroform fumigation and the products of their decomposition (CO<sub>2</sub>-C, NH<sub>4</sub>-N, and NO<sub>3</sub>-N) are measured over a 20-d incubation. The difference in levels of decomposition products between irradiated/fumigated and control samples is microbial biomass.

#### Citations

Islam, K.S., R.R. Weil. 1998. Microwave irradiation of soil for routine measurement of microbial biomass carbon. *Biol. Fertil. Soils.* 27:408-416.

Jenkinson, D.S., and D.S. Powlson. 1976. The effects of biocidal treatments on metabolism in soil – V. A method for measuring soil biomass. *Soil Biol. Biochem.* 8:209-213.

Shen, S.M., G. Pruden, and D.S. Jenkinson. 1984. Mineralization and immobilization of nitrogen in fumigated soil and the measurement of microbial biomass nitrogen. *Soil Biol. Biochem.* 16:437-444.



## Particulate Organic Matter

### What is it?

Particulate organic matter (POM) is the fraction of mineral-associated organic matter  $\geq 53\text{-}\mu\text{m}$ .

### Why is it important?

POM possesses characteristics of the intermediately-labile soil organic matter pool. This pool is one of the first to be depleted as a result of cultivation. Because of its labile characteristics, POM has promise as being an early-warning indicator of long-term changes in soil quality.

### How is it measured?

Soil is dispersed with hexametaphosphate and physically fractionated by sieving. Material retained on the  $\geq 53\text{-}\mu\text{m}$  sieve (POM) is weighed and its carbon and nitrogen content is determined by dry combustion.

#### Citations

Cambardella, C.A., and E.T. Elliott. 1992. Particulate soil organic matter changes across a grassland cultivation sequence. *Soil Sci. Soc. Am. J.* 56:777-783.

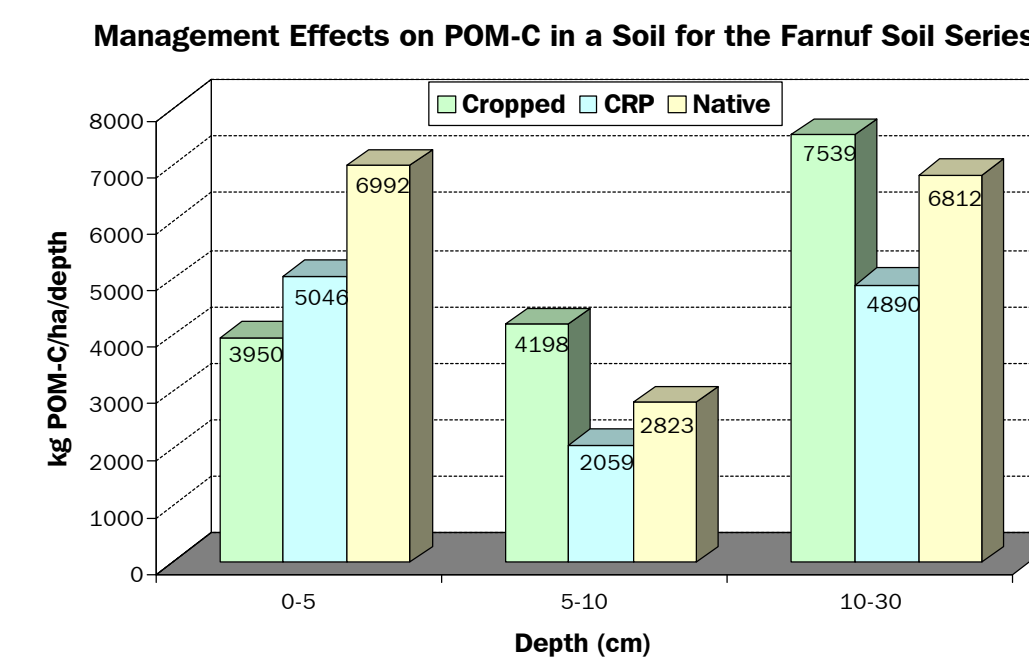


Photo of the native site on the Farnuf soil series in North Dakota.

(classification: fine loamy, mixed superactive, frigid Udic Argiustoll)



## Root Biomass

### What is it?

Root biomass refers to the mass of roots in the soil.

### Why is it important?

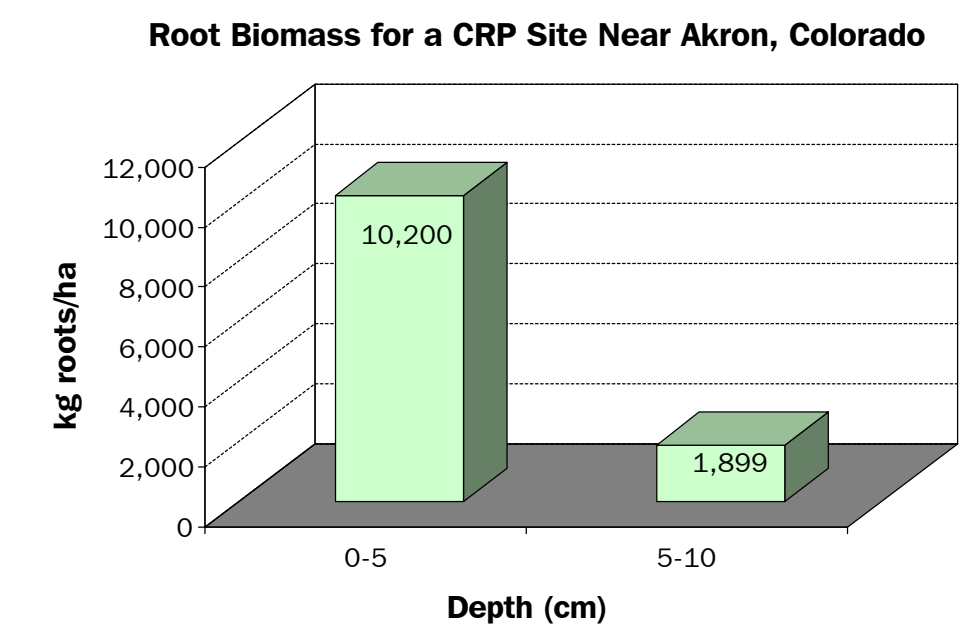
Roots are a source of carbon. Carbonaceous materials are also released from roots to the soil. As a result, the area surrounding roots generally possesses high levels of microbial activity.

### How is it measured?

A 500-g soil sample is gently washed until only roots remain. Roots are oven-dried (68°C), weighed, ground to <80-mesh, and analyzed for total C, N, P, and S.

#### Citations

Brown, G.R. and J.F. Thilenius. 1976. A low-cost machine for separation of roots from soil material. *Journal of Range Management.* 29:506-508.



## Summary

Soil microbial biomass, particulate organic matter, and root biomass are measured by the National Soil Survey Laboratory Soil Biology and Carbon Research Program. This program gives scientists additional information to enhance their knowledge of soil biological characteristics and how they are affected by land management practices.

## Acknowledgements

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